be detected and protective measures can be undertaken. The voltage is determined at the beginning and end of the injection pause. Because the injection pause can last only several milliseconds (for example, 2 ms) with the charged actuator, significant discharge occurs during a short circuit. For a system with multiple injection, voltage monitoring may be performed for individual injection pulses, so that fault event may be detected early.

In the exemplary embodiment, an inductor 14 is connected between switches 3a and 3b whose second terminal is connected to a terminal of piezoactuator 5 via a cable harness and a plug connector 7. A second terminal of piezoactuator 5 is connected to a second switch 4 via a plug connector 8 and cable harness 6a, the return line of the second switch being connected to the return line of voltage source 1 (ground wire). Voltage source 1 as well as switches 3a, 3b and 4 are connected to a control device 2 via control lines 11a, 11b, 12 and 13. The current flow can be controlled using first switches 3a and 3b. To this end, control device 2 sets first switches 3a and 3b to transmission mode or blocks them. Control device 2 also includes a measurement unit 9 that measures the voltage, the voltage variation, or a change in voltage, for example, to plug connectors 7 and 8, to actuator 5, and/or cable harness 6, 6a.

The dotted line to plug connector 7 with resistor R_M represents a leakage resistance that could occur, for example, upon contact by a person. In an injection pause, for example, when piezoactuator 5 is charged, measurement unit 9 detects the voltage of piezoactuator 5 at plug connector 7 such that the voltage can be evaluated by control device 2. If first switches 3a, 3b, for example, are blocked, piezoactuator 5 discharges through leakage resistor R_M fairly rapidly since R_M has relatively low resistance. The voltage may be measured at the end of the injection pause. It is not necessary to measure at the beginning of the injection pause because at this point piezoactuator 5 was charged to the setpoint voltage specified by control device 2. From these two values, the voltage difference dU is determined after each charging process and compared to a predefined threshold value S. If the voltage difference dU lies below the predefined threshold value S, it can be concluded that no significant leakage current (which can be formed by the human body) resistance R_M is present. On the other hand, if the voltage difference dU exceeds the predefined threshold value S, a fault message is produced, voltage source 1 is shut off as promptly as possible, and/or piezoactuator 5 is discharged. This takes place with the assistance of switches 3a, 3b and 4. Hazard from contact with parts conducting high voltage is thereby advantageously avoided.

The Divljakovic 765 and Divljakovic 947 references relate to a method for

3

prognosticating a potential failure condition of an apparatus. According to the Divljakovic references, to predict a future failure of components within an apparatus or system, the power spectral density ("PSD") of certain signals provided by an apparatus, such as a marine propulsion system, are monitored. The Divljakovic references assert that the power spectral density can be used to identify subtle changes in the operation of certain components within a marine propulsion system.

The Divljakovic references simply do not identically describe (or even suggest) the claim feature of determining a change in a predefined voltage as in claim 1. In particular, referring to Fig. 1 of the Divljakovic references, by periodically monitoring the PSD of a selected parameter, a reference profile, or magnitude may assertedly by developed. According to the Divljakovic references, it might be determined that a particular frequency range R or the PSD profile is particularly indicative of a certain type of mechanical or electrical failure. Once the precursor frequency range R is determined, a monitoring system continually measures the PSD and provides a profile of the PSD as a function of frequency. The reference profile is then stored for later comparison to periodically updated current magnitudes of the PSD. A micro-processor is connected in signal communication with equipment to receive the PSD data and determines when a difference occurs between the reference magnitude and the most current PSD profile within the range R, and then compares the magnitude difference to a predetermined allowable differential. If the calculated difference exceeds the allowed differential, an alarm condition can be signaled to the operator of the apparatus.

A PSD, profile or integral profile of a PSD is not a predefined voltage as recited in the context of claim 1. Rather, a PSD refers to the power of a time series as a function of frequency (that is, the dimension is power per unit frequency). It may be computed by taking the Fourier transform of the autocorrelation sequence of the time series or by obtaining the squared modulus of the Fourier transform of the time series scaled by an appropriate constant. In either case, computation of the PSD requires an appropriate time interval to obtain meaningful frequency information for the relevant frequencies of interest. This fact is reflected by considering Fig. 18 of Divljakovic 765, in which the determination of the reference magnitude requires a significant time period (for example, 20 hours). Moreover, the use of a PSD profile or the integral of a PSD profile is fundamentally different from determining a change in a predefined voltage, as recited in the context of claim 1, since the claimed subject matter is designed to function on very short time scales. In particular, a

4

capacitance of 6 microfarads for example, for piezoactuator 5, and an assumed leakage resistance R_M of 1K ohm results in a time constant of approximately 6 ms. In an injection pause of 2 milliseconds for a double-switching control valve, for example, actuator 5 is discharged by up to 60 volts.

The Rueger reference relates to a method and device for controlling a controller having a capacitive element. As characterized, an ohmic resistor is connected in parallel to the capacitive element, and the value of the ohmic resistor is determined at certain times and then the type and/or temperature of the capacitive element is deduced on the basis of the value of the resistor. As further characterized, the value of the resistor is determined using time constant analysis, in particular using two voltage decay values across the capacitive element in conjunction with the known capacitive value. In particular, the capacitive element is charged to a defined voltage U, and at the same time, a time meter t is set to zero. A subsequent query determines whether the value of the time meter t is greater than or equal to a time threshold t1. If not, the time meter is incremented and a query is again performed. If the time meter t is greater than or equal to the time threshold t1, then the voltage U1 is measured. Next, the query determines whether the content of the time meter is equal to or greater than a second time threshold t2. If not, then the time meter is incremented by 1. If so, then the value U2 of the voltage at time t2 is determined.

For an RC element, the voltage drops according to an exponential function, which is determined essentially by a time constant. By measuring the voltage at two different times, the time constant can be determined, and thus for a known capacitance of a capacitive element, the value R of the resistor can be determined.

Thus, the Rueger reference does not identically describe (or even suggest) determining a change in a predefined voltage. Rather, Rueger only refers to measuring two different voltage values U1 and U2 and respective time points t1 and t2. This data may then be used to provide the corresponding time constant and the resistive value. There is no relation here to predefined voltage. Moreover, Rueger does not identically describe (or even suggest) any step of reporting a fault when a change in a predefined voltage exceeds a predefined threshold.

Accordingly, since the Divljakovic 765, Divljakovic 947 and Rueger references do not identically describe (or even suggest or refer to) determining a change in a predefined voltage -- as they must for anticipation, it is respectfully submitted that claim 1 is allowable. Claims 2-4, 9 and 10 from claim 1, and are therefore allowable, for the same reasons as claim 1.

5

Claim 11 includes limitations similar to those of claim 1, and is therefore allowable for essentially the same reasons as claim 1.

Claims 5-8 were rejected under 35 U.S.C. § 103(a) as unpatentable over the Divljakovic 765, Divljakovic 947 or Rueger references. To reject a claim as obvious under 35 U.S.C. § 103, the prior art must disclose or suggest each claim element and it must also provide a motivation or suggestion for combining the elements in the manner contemplated by the claim. See Northern Telecom, Inc. v. Datapoint Corp., 908 F.2d 931, 934 (Fed. Cir. 1990), cert. denied, 111 S. Ct. 296 (1990); In re Bond, 910 F.2d 831, 834 (Fed. Cir. 1990). Thus, the "problem confronted by the inventor must be considered in determining whether it would have been obvious to combine the references in order to solve the problem." Diversitch Corp. v. Century Steps, Inc., 850 F. 2d 675, 679 (Fed. Cir. 1998).

As discussed above, the Divljakovic 765, Divljakovic 947 and Rueger references, whether taken alone or in combination, do not describe or suggest the claim feature of determining a change in the predefined voltage. Since claims 5 to 8 depend on claim 1, claims 5 to 8 include this limitation, and are therefore allowable for essentially the same reasons as claim 1.

In summary, it is respectfully submitted that all of claims 1 to 11 are allowable for the foregoing reasons.
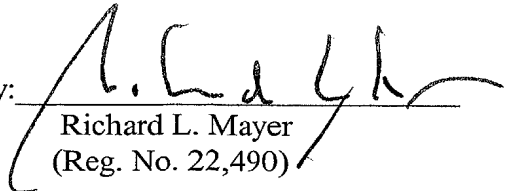
CONCLUSION

In view of all of the above, it is believed that the objection and the rejections have been obviated, and that claims 1 to 20 are allowable. It is therefore respectfully requested that the objection and the rejections be withdrawn, and that the present application issue as early as possible.

Respectfully submitted,

Dated: 12/12/02

By: _____
Richard L. Mayer
(Reg. No. 22,490)

KENYON & KENYON
One Broadway
New York, New York 10004
(212) 425-7200
CUSTOMER NO. 26646

535972v.2

6